TRADE-OFF BETWEEN FARM PRODUCTION AND FLOOD ALLEVIATION USING TILLAGE AS NATURAL FLOOD MANAGEMENT (NFM) STRATEGY.

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Introduction
Primarily, tillage practices are realized for management of crop production. They also serve as natural flood management (NFM) strategy to create soil surface roughness, improving water absorption, infiltration, and storage in soil profile. But mechanical working damages soil structure and causes compaction, erosion, and soil organic carbon loss which aggravate flooding risks during rainfalls. Importantly, adverse above phenomena develop over time with fewer awareness of causalities and evidences in changing climate. Hence, inspired towards heavy tillage could aggravate flooding risk compromising crop production futuristically. We conducted this study to highlight tillage as NFM strategy towards sustainable resolution.

Objectives
Followings are the main objectives of this study anchoring tillage as NFM strategy:
- To identify interacting (causal) variables towards flood alleviation and farm production.
- To develop a meta-model e.g., Bayesian Belief Network (BBN) for tillage as NFM.
- To quantify variables in the BBN model exhibiting their strength and sensitivity.
- To measure trade-off relationship between flood alleviation and farm production using tillage as NFM strategy.

Methodology
A BBN model for tillage is developed with causal variables to eminence their impacts on flood alleviation and farm production to quantify their influence based on their potential strength of interactions. This can help decide practitioners for their informed choices.

i- Exploring interacting (causal) variables
We developed a novel approach called “Scientific Published Literature (PSL)” to identify interactive (causal) variables in a multi-domain studies and successfully applied.

ii- Elicitation of experts’ knowledge
Semi-structured interviews were conducted from six (6) domain experts and developed individual Bayesian network structure.

iii- Constructing BBN structure
Below variables were commonly identified by all six domain experts as well as through PSL.

BBN Model for tillage
A BBN model for tillage shows three sub-models.

Sub-model I has brown nodes using climatic variables (e.g., rainfall & temperature) and crop (wheat) growth variables with simulated data generated through DSSAT model for its parametrization.

Conclusions
This BBN depicts the following inferences.
- Propensity to full tillage practices increases farm yield along with increased soil compaction generating higher runoff and resultantly reduces the effect of flood alleviation but the vice versa if reduced tillage is opted.
- Tendency to increasing arable & arable with grasslands farming systems also increases the farm yield involving more tillage triggering increased compaction causing higher runoff and resultantly exhibiting reduction in flood alleviation but the vice versa if grasslands or woodlands opted comparatively.
- There exists a trade-off relationship between flood alleviation and farm yield using tillage as NFM strategy.

References
*Source: https://loddonobservatory.org/loddon-catchment/ https://dssat.net/

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